



Ag 20/20 Program Concept Paper

I. Purpose of Ag 20/20

Although the United States has the largest and most productive agricultural sector in the world, producers are increasingly challenged by skyrocketing production costs, decreasing profits, and an overall high level of risk. Producers must continuously strive to increase profit margins by finding new ways to decrease crop inputs and/or increase crop quality and production efficiency. One opportunity to achieve these goals is through the use of remote sensing, GPS, GIS, and other spatial-information technologies that support decision-making. Remote sensing has been utilized in agriculture to various degrees of success over the past two decades, but with numerous companies preparing to launch new satellites to capture higher-quality images at rapid re-visit rates and to distribute the data faster and at lower prices, an opportunity exists for the agricultural community to develop innovative information tools to address the challenges facing nearly every farmer.

Link USDA, NASA and growers to improve agriculture profit margins.

Toward this purpose, a team of producers, grower associations, extension agents, academic researchers, and representatives of NASA and USDA are organizing a program called **Ag 20/20** to generate integrated remote-sensing-based tools that improve profit margins for commodity producers. There is an urgent need to revolutionize farming practices by integrating reliable and up-to-the-minute information into the farmers' decision-making processes. Ag 20/20 will pursue this need by envisioning not a stand-alone, "silver-bullet" remote sensing solution, which is unrealistic, but integrated decision-support system solutions that include remote sensing and other technologies. Ag 20/20 will take into account both common needs among commodity growers and regional differences in crop production systems.

Ag 20/20, a five-year program targeted for \$11 million in funding starting in FY2001, will bring together growers and agricultural remote sensing experts to solve key production problems, to co-invest with the private sector in bringing decision-support tools to the marketplace, and to educate growers on the use of this technology. Growers will be active participants in Ag 20/20, guiding researchers in every step from prioritization of research to evaluation of results.

II. Background

Ag 20/20 emerged from a series of initiatives spanning the past several years. Throughout the 1990s, NASA, USDA, and land-grant universities have been exploring remote sensing applications in agriculture according to the needs and requirements of growers. Then, in 1998, USDA Secretary Dan Glickman and NASA Administrator Dan Goldin signed a Memorandum of Understanding for their two agencies to work together toward the benefit of American agriculture. USDA would bring to the table its agricultural expertise, and NASA would offer its remote sensing

Focus current and future applied research on growers' information needs.

proficiency. Both groups recognized the criticality of including growers, grower associations, land-grant universities, and other government agencies into the program.

On August 12-13, 1999, members of the National Corn Growers Association, National Cotton Council, The Cotton Foundation, American Soybean Association, United Soybean Board, National Association of Wheat Growers, plus individual growers, university researchers, and personnel from NASA, USDA, and other agencies convened at Stennis Space Center, Mississippi to develop a foundation for the Ag 20/20 program. (Although the workshop focused on corn, cotton, soybeans, and wheat, additional crops will be addressed as Ag 20/20 develops.) The goals of the workshop were to assess growers' crop information needs, to assess the current state of agricultural remote sensing research, and to find gaps between these two assessments, so that the Ag 20/20 program may be wisely managed and effectively executed. Results of the workshop are presented in the sections that follow.

III. Goals, Objectives, and Outcomes of Ag 20/20

The overall **goals** of Ag 20/20 are to:

- increase the production efficiency of the American farmer;
- reduce crop production risks;
- address environmental concerns associated with agricultural production.

***Decrease
production
costs;
increase
yields;
improve
quality;
increase
profits.***

Ag 20/20 will reach these goals via the following **objectives**:

- assess growers' needs and target research to address these needs, to maximize the relevancy of the program;
- implement and verify the development of remote-sensing-based information tools that solve grower problems, that are made available to growers on the commercial market, and that involve growers at all stages;
- educate the grower as to the use, limits, and benefits of these information tools;
- coordinate and manage program resources to maximize impact, eliminate redundancy and irrelevancy, and sustain a successful private-public partnership.

As a result of Ag 20/20, the following **outcomes** are foreseen:

- a suite of reliable and easy-to-use remote-sensing-based information tools and services on the commercial market for the American farmer, created by the private sector through partnership with Ag 20/20;
- a body of research documenting *how* to apply remote sensing to solve agricultural problems such as site-specific fertilizer application, detection and precision-spraying of weed and insect outbreaks, detection and treatment of stressed areas, and numerous other priority problems;
- a grower community that is a wise consumer of remote sensing products and services;
- a remote sensing community that is a wise provider of data and tools that address the needs of American farmers.

***New decision
support tools
for American
farmers.***

IV. Management

A Program Management Council (PMC), with representatives from the four commodity associations, NASA, and USDA, will provide oversight of the five-year Ag 20/20 initiative. See **VI. Next Steps** below.

***Strategic
partnerships
and
investments***

V. Workshop Findings: Grower Needs and Baselines to Guide Ag 20/20

The August 1999 NASA/USDA/Growers' Workshop assembled representatives of corn, cotton, soybean and wheat commodity groups to prioritize their crop's key information needs. Tables 1 and 2 below (as well as the crop-specific tables that follow) display the aggregated results of the prioritization exercises conducted at the workshop. While the managers of Ag 20/20 are not bound to these results as presented here, this information should play a guiding role in activities over the next five years, since it derives from the growers themselves and incorporates researchers' input as well.

Table 1 below presents a synthesis of the priority information needs gathered from the growers of all four crops who participated in the workshop. The first block in the table below ("Priorities common to all four crops") lists those production decisions that appeared on all four crops' top-priority lists. The second block ("Additional top three priorities") represents the top three priorities from any of the crops that were not already accounted for in the common-priority block. See Tables 3 to 6 for a breakdown of these data on a crop-by-crop basis.










Table 1. Synthesis of All Growers' Priority Information Needs

	Priority	Objective
Priorities common to all four crops	Nutrient application	Optimal allocation of fertilizer to reduce input costs and improve production efficiency.
	Weed scouting/ herbicide application	Effective weed detection and management to reduce herbicide costs and inputs.
	Insect scouting/ insecticide application	Effective insect management to reduce pesticide costs and inputs.
	Irrigation/ soil moisture information	Optimization of soil water resources and improved management of irrigation water.
Additional top three priorities	Yield	Development of tools to (1) optimize yield and (2) predict/forecast yield for marketing decisions.
	Soil characterization	Identification of soil management zones for improved decision-making.
	Vigor/stress detection	Determination of crop response to varying field and weather conditions to improve decision-making process.
	Grain quality	Characterization of grain-quality factors (oil, protein, etc.) for appropriate harvest and market decisions.
	Next season preparation	Assessment of physical properties of fields after harvest to support planning of upcoming crop.

Table 2 below presents the same priority needs shown in Table 1 (priorities for all four crops synthesized together), but reorders them based on their current development stage. Those priorities that were judged to be farther along in research and approaching the level of commercial product are listed first, while those priorities that were judged to be more toward the basic-research stage are listed later. The triangles and years indicate the general time frame in which we expect the research dedicated to that priority to start to mature to the level of large-scale field tests and new commercial products and services. While Ag 20/20 managers should not be bound to these rankings in the management of the program, they do represent the most important requirements of the growers and the "lowest hanging fruit" as

indicated by the researchers, and therefore should be weighted heavily in management decisions.

Table 2. Synthesis of All Growers' Priority Information Needs, Ranked by Development Stage

		Basic research	Applied research	Large-scale field tests	New products/ services to growers
Priority	Objective				
Vigor/stress detection	Determination of crop response to varying field and weather conditions to improve decision-making process.			2001	2002
Next season preparation	Assessment of physical properties of fields after harvest to support planning of upcoming crop.			2001	2002
Irrigation/ soil moisture information	Optimization of soil water resources and improved management of irrigation water.			2001	2002
Weed scouting/ herbicide application	Effective weed detection and management to reduce herbicide costs and inputs.			2002	2003
Insect scouting/ insecticide application	Effective insect management to reduce pesticide costs and inputs.			2002	2003
Nutrient application	Optimal allocation of fertilizer to reduce input costs and improve production efficiency.			2002	2004
Soil characterization	Identification of soil management zones for improved decision-making.			2002	2004
Yield	Development of tools to (1) optimize yield and (2) predict/forecast yield for marketing decisions.			2003	2005
Grain quality	Characterization of grain-quality factors (oil, protein, etc.) for appropriate harvest and market decisions.			2004	2005

Growers' priorities focus the strategic investments.

Tables 3 to 6 below present the priorities of growers organized by crop—corn, cotton, soybean, and wheat. These are the data that were aggregated to form Tables 1 and 2 above. The tables below summarize the growers' top-priority information needs, current research against these needs (based on researchers' input during the workshop), and a projected timeframe as to when a remote sensing tool will satisfy this need (also based on researchers' input). See note on page 6 for more information.

Table 3. Corn: Top-Priority Information Needs		
Top Priorities (in order as listed by growers)	Current quantity of remote sensing research toward this priority: Low- 1-2 projects Medium- 3-5 projects High- Over 5 projects	Time frame in which this priority may be met: Short term (0-18 months) Medium term (19-36 months) Long term (37-60 months)
Yield	High	Long term
Nutrient application	High	Medium term
Grain quality	Low	Long term
Weeds	Medium	Medium term
Irrigation	Low	Medium term
Population	Low	Long term
Insects	Low	Medium term
Replant	Low	Medium term
Diseases	Low	Medium term
Drainage	(no projects)	(no projects)

Table 4. Cotton: Top-Priority Information Needs		
Top Priorities (in order as listed by growers)	Current quantity of remote sensing research toward this priority: Low- 1-2 projects Medium- 3-5 projects High- Over 5 projects	Time frame in which this priority may be met: Short term (0-18 months) Medium term (19-36 months) Long term (37-60 months)
Insects	High	Long term
Soils	High	Long term
Next season preparation	Low	Medium term
Irrigation	High	Long term
Vigor/stress	Low	Medium term
Herbicide	Low	Long term
Nutrient application	High	Long term
Marketing	Low	Medium term
Maturity/termination	Low	Long term

Growers' priorities focus the strategic investments

Table 5. Soybean: Top-Priority Information Needs		
Top Priorities (in order as listed by growers)	Current quantity of remote sensing research toward this priority: Low- 1-2 projects Medium- 3-5 projects High- Over 5 projects	Time frame in which this priority may be met: Short term (0-18 months) Medium term (19-36 months) Long term (37-60 months)
Nutrient application	Medium	Medium term
Residue management	(no projects)	(no projects)
Weeds/herbicide	High	Medium term
Irrigation	Low	Long term
Drainage/soil moisture	Medium	Medium term
Diseases	Low	Medium term
Yield/yield potential	High	Medium term
Variety selection	(no projects)	(no projects)
Plant population	Low	Long term
Grain quality	(no projects)	(no projects)
Insects	Low	Medium term

Table 6. Wheat: Top-Priority Information Needs		
Top Priorities (in order as listed by growers)	Current quantity of remote sensing research toward this priority: Low- 1-2 projects Medium- 3-5 projects High- Over 5 projects	Time frame in which this priority may be met: Short term (0-18 months) Medium term (19-36 months) Long term (37-60 months)
Nutrient application	High	Medium term
Vigor/stress	Low	Medium term
Weeds	Low	Long term
Insects	Low	Long term
Diseases	(no projects)	(no projects)
Yield	High	Medium term
Grain quality	Low	Long term
Replant	Low	Long term
Marketing	Low	Medium term
Irrigation/soil moisture	Medium	Medium term
Weather prediction	Medium	Medium term
Residue management	(no projects)	(no projects)

Notes on Tables 3 to 6:
Column 1 lists growers' top priorities by commodity. Each grower ranked the importance of over 30 different production decisions and then agreed upon those that were the most critical.
Column 2 tabulates the current quantity of research by participating agencies, associations, and land-grant universities that address a particular crop priority.
Column 3 lists an estimated time frame needed to bring a remote sensing solution to the marketplace to address a particular priority. Basic research projects were ranked as long-term; commercial product-oriented projects were designated short-term.

Collectively, the information presented in the above tables will help guide initial Ag 20/20 efforts toward the resolution of top-priority crop needs through remote sensing.

VI. Next Steps

Implementing Ag20/20 will require an integrated approach of research, demonstration, education, and product development, executed through a variety of mechanisms. Initial milestones include:

- **September 1999:** Ag 20/20 Program Management Council meeting in Washington, D.C., to discuss this concept paper and budgetary matters;
- **November 1999:** Second Grower Workshop in Beltsville, Maryland, to solidify Ag 20/20 concept with grower associations prior to the associations' annual wintertime conferences;
- **January 2000:** Planned announcement of open solicitation for agricultural remote sensing research projects, at the ERIM Second International Conference on Geospatial Information in Agricultural and Forestry, Orlando, Florida.

VII. Budget

New federal funding is being sought for FY2001, with USDA and NASA working through the federal budget process to request \$5 million each in the President's Budget. Grower associations will be asked to consider providing \$1 million collectively for FY2001. The total of \$11 million for FY 2001 will be used to address research, commercialization, and educational objectives. Growers will continue to be involved in the design and implementation of the program.